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Prevalence of Healthcare-Associated Infections in Acute Care Hospitals in Jacksonville, Florida

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Abstract

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The study described herein was presented in abstract form at the Fifth Decennial International Conference on Healthcare-Associated Infections, March 18-22, 2010, Atlanta, GA (Abstract #911).

Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention/the Agency for Toxic Substances and Disease Registry.

Conflicts of interest
Mobeen Rathore, MD: consultant for Pfizer. All other authors: No conflict.

Objective—To determine healthcare-associated infection (HAI) prevalence in nine Jacksonville, FL hospitals, evaluate the performance of proxy indicators for HAIs, and refine methodology in preparation for a multi-state survey.

Design—Point prevalence survey.

Patients—Acute care inpatients of any age.

Methods—HAIs were defined using National Healthcare Safety Network criteria. In each facility a trained Primary Team (PT) of infection prevention (IP) staff performed the survey on 1 day, reviewing records and collecting data on a random sample of inpatients. PTs assessed patients with ≥1 proxy indicator (abnormal white blood cell count, abnormal temperature, or antimicrobial therapy) for the presence of HAIs. An external IP expert team collected data from a subset of patient records reviewed by PTs to assess proxy indicator performance and PT data collection.

Results—Of 851 patients surveyed by PTs, 51 had ≥1 HAI (6.0%, 95% confidence interval 4.5–7.7%). Surgical site infections (n=18), urinary tract infections (n=9), pneumonia (n=9), and bloodstream infections (n=8) accounted for 75.8% of 58 HAIs detected by PTs. *Staphylococcus aureus* was the most common pathogen, causing 9 HAIs (15.5%). Antimicrobial therapy was the most sensitive proxy indicator, identifying 95.5% of patients with HAIs.

Conclusions—HAI prevalence in this pilot was similar to that reported in the 1970s from CDC's Study on the Efficacy of Nosocomial Infection Control. Antimicrobial therapy was a sensitive screening variable with which to identify higher-risk patients and reduce data collection burden. Additional work is needed on validation and feasibility to extend this methodology to a national scale.

Background

Significant progress has been made in recent years to implement effective infection prevention strategies in U.S. healthcare facilities and reduce the occurrence of some preventable healthcare-associated infections (HAIs). Despite this progress, a recent analysis of HAI burden and cost using data reported to the Centers for Disease Control and Prevention's (CDC's) National Healthcare Safety Network (NHSN) indicates that HAIs remain a serious public health problem in the United States.[1] To develop, target, and implement effective HAI surveillance and prevention strategies in U.S. hospitals, a full understanding is needed of the types of HAIs and the affected patient populations.

Single- and small multi-center prevalence surveys have been utilized in U.S. hospitals since the 1960s as a simple method by which to describe HAI burden and evaluate the effectiveness of surveillance programs.[2–5] In the earliest of these studies, performed at Boston City Hospital, 13.4% of patients surveyed over a one-week period had an infection that was not present on admission to the hospital.[2] In a 6-hospital, CDC-run survey conducted in 1965–1966, the adjusted nosocomial infection rate was 3.5 per 100 discharges.[4] These early efforts informed the development and implementation of the CDC's National Nosocomial Infections Surveillance (NNIS) system and the Study on the Efficacy of Nosocomial Infection Control (SENIC) in the 1970s. SENIC was a $27 million, multi-phase effort in which teams of trained CDC data abstractors reviewed medical records

of 169,526 patients from a stratified random sample of 338 hospitals over a one-year period.[6,7] In the SENIC project, 5.23% of hospitalized patients acquired one or more HAIs.[7]

Hospital-wide surveillance in selected hospitals continued in the NNIS system until 1996. At that time, in response to increasing demands on infection control personnel, NNIS hospitals moved from hospital-wide surveillance toward targeted surveillance in high-risk inpatient areas such as intensive care units. In 2002, CDC epidemiologists used NNIS data from 1990–2002 and estimated the total number of HAIs in the United States to be 1.7 million, or 4.5 infections per 100 admissions.[8]

CDC's current HAI surveillance system, the NHSN, replaced NNIS in 2005; over 4500 healthcare facilities across the country report some device- and procedure-associated HAIs in selected hospital locations to NHSN. However, most facilities do not report data on all HAI types present in all acute care patient populations. Therefore, measurements of the magnitude of all types of HAIs occurring hospital-wide, needed to inform decisions by local and national policy makers and by hospital infection control personnel regarding appropriate targets and strategies for HAI surveillance and prevention, are not currently readily available on a national scale from NHSN. Such estimates can be obtained in a resource-effective way through point prevalence surveys; these surveys can also be repeated at regular intervals to assess HAI and antimicrobial use trends over time.[9] Multiple countries have used prevalence surveys to estimate the scope of their HAI problems.[10–32] Some investigators have evaluated screening approaches (e.g., using proxy indicators to identify patients most likely to have HAIs) to reduce the number of patients needing to be fully evaluated, therefore providing a more feasible approach to conducting large-scale prevalence surveys.[33,34]

To inform the development of a large, multi-state U.S. HAI point prevalence survey, we conducted a pilot survey in collaboration with the Florida Department of Health and nine acute care hospitals in Jacksonville, Florida. The primary objectives of this pilot survey were to: 1) estimate HAI prevalence in a random sample of inpatients; 2) describe the distribution of HAIs by major infection site and causative pathogens; 3) evaluate the performance of proxy indicators in identifying patients with HAIs; and 4) evaluate the accuracy and reliability of prevalence survey data collection.

Methods

Survey design, hospitals and patient selection

Nine acute care hospitals located in the Jacksonville, FL metropolitan area volunteered to participate in the survey. Following approval by the CDC Institutional Review Board (IRB) and by IRBs of participating hospitals, each hospital conducted the survey on a single day (Tuesday through Thursday) in August 2009. The Florida Department of Health determined the survey to be a non-research surveillance activity.

Patients of any age hospitalized in acute care inpatient units were eligible for inclusion. Patients were not eligible if they were in non-acute care or outpatient areas; in psychiatric units, rehabilitation units or skilled nursing units; in the emergency department; or on observation status in an acute care inpatient unit with a length of stay <24 hours at the time

of the survey. The hospital census on the morning of the survey was used to generate a random sample of eligible patients to be surveyed.

Training and data collection

Data were collected on paper forms by infection preventionists (IPs) and other designated personnel working in their own hospitals; these hospital-based teams were called the Primary Teams (PTs). Prior to the survey dates, PTs participated in approximately 6 hours of training in NHSN HAI terms and definitions and survey procedures. PTs completed most of their data collection activities on the survey date, but were permitted an additional 14 days after the survey date to complete data collection when necessary, as long as all data collection remained restricted to information present (or cultures collected) on or prior to the survey date. In addition to limited demographic and clinical information, data collection included information on the presence of proxy HAI indicators on the survey date or the calendar day prior to the survey date (white blood cell count <4,000 cells/mm^3 or ≥12,000 cells/mm^3 [≥15,000 cells/mm^3 for infants ≤1 year]; temperature >38°C for all ages or <36°C for infants ≤1 year; and whether the patient was on antimicrobial agents).

To identify active HAIs, PTs performed comprehensive medical record review for those patients with ≥1 proxy indicator. HAIs were defined according to NHSN criteria,[36] and were identified as being active if signs and symptoms of the HAI were present on the survey date, or signs and symptoms of the HAI were present prior to the survey date and the patient was still receiving antimicrobial treatment for that HAI on the survey date. PTs reported only those HAIs that were attributed to their own hospitals; active HAIs detected on the survey date that were attributed to other healthcare facilities were not reported.

Paper forms labeled with hospital and patient identification codes were returned to CDC for analysis. Identification codes (called CDC ID codes) were created for the survey and contained no personal identifiers. The links between CDC ID codes and hospital and patient identifiers were known only to each individual hospital.

Evaluation Team assessment of proxy indicator performance and PT surveillance

An Evaluation Team (ET), composed of 4 experienced IPs who were from outside of Jacksonville, FL and were serving as expert reviewers, performed an assessment of proxy indicator performance and an evaluation of the data collected by the PTs. The ET attempted to perform comprehensive medical record review (regardless of the presence of proxy indicators) for every other patient on the PTs' lists of patients randomly selected for inclusion in the survey. Due to time constraints, the ET reviewed records of a 40% subset of the patients reviewed by the PTs. ET members traveled to each of the hospitals on the survey dates and performed assessment activities in parallel with PT members. ET members also completed HAI criteria worksheets for those patients determined to have HAIs. PT members provided the ET with brief orientations to the hospitals and medical record systems on the mornings of the survey dates. Other than these orientations, the ET and PTs operated independently and were not permitted to discuss or exchange information regarding surveyed patients.

Following CDC's review of the data, PT members re-reviewed medical records of patients for whom the PT and ET made differing HAI determinations. ET HAI criteria worksheets were used to determine how ET HAI determinations were made for discrepant cases, and for some discrepancies the ET leader returned to a participating hospital to re-review medical records. After completion of these re-reviews a Resolution Team (RT), composed of PT members, the ET leader, and Florida Department of Health and CDC prevalence survey personnel, was convened. The RT held conference calls with a representative of each PT to discuss HAI discrepancies and make decisions regarding correct HAI determinations. The RT focused on major discrepancies, defined as discrepancies in which one team determined the patient had an HAI and the other team determined the patient did not have an HAI.

Analysis

To estimate the survey sample size, we used the standard sample size formula for random samples. Using an estimated HAI prevalence of 10% and a desired precision of ±2% we estimated the desired survey sample size to be approximately 864 patients. This total estimated sample size was divided between the participating hospitals in a manner proportional to each hospital's average daily census, such that each PT was asked to review approximately 33% of its average daily census.

Data were entered into a Microsoft Access 2007 database and analyzed in SAS version 9.2 (SAS, Inc., Cary, NC) and OpenEpi version 2. Confidence intervals around prevalence estimates were generated using the mid-P exact method. A descriptive analysis of HAIs and major HAI discrepancies was performed. Sensitivity, specificity, positive and negative predictive values of proxy indicators (as collected by the ET) in detecting HAIs were calculated.

Results

Patients

A total of 857 patients identified by unique CDC ID codes were surveyed by the PTs. Six patients were excluded because of data coding errors or incomplete data collection. Therefore, 851 patients (47 to 175 patients in each participating hospital) were included in the analysis. The median patient age was 54 years (interquartile range [IQR] 33–69 years). More than a quarter of all surveyed patients had a device in place on the survey date, had undergone an operative procedure during the current hospital admission, or had a previous admission to the survey hospital within 3 months prior to the survey date (Table 1).

Prevalence and distribution of HAIs and pathogens identified by PT surveillance

A total of 489 patients (57.5%) had ≥1 proxy HAI indicator and underwent comprehensive medical record review by the PTs. PTs detected 58 HAIs in 51 patients; 7 patients had 2 HAIs each. The prevalence of patients with ≥1 HAI was 6.0% (95% CI 4.5–7.7%). Surgical site infection (SSI) was the most common HAI type, accounting for 18 of 58 HAIs (31.0%). Ten SSIs (55.6%) were organ/space infections, 4 (22.2%) were deep incisional, and 4 (22.2%) were superficial incisional infections. Pneumonia (PNEU), urinary tract infection (UTI) and bloodstream infection (BSI) were also prevalent, each accounting for >10% of

HAIs (Table 2). Overall, these 4 HAI types accounted for 75.8% of all HAIs detected by the PTs. Of the 40 non-SSI HAIs, 15 (37.5%) were attributed to non-ICU ward locations, 13 (32.5%) to critical care units, 4 (10%) to stepdown units, and 4 (10%) to specialty care areas. Locations of attribution were missing or unknown for 4 non-SSI HAIs (10%).

Pathogens were reported for 41 HAIs detected by the PTs (70.7%). A single pathogen was reported for 34 of 41 HAIs (82.9%), and multiple pathogens were reported for 7 HAIs (17.1%). *Staphylococcus aureus* (SA) was the most common pathogen (9 HAIs, 15.5% of all HAIs). Other pathogens reported for ≥1 HAI included *Candida* species (6 HAIs), *Pseudomonas aeruginosa* (5), coagulase-negative staphylococci (5), *Enterococcus* species (5), *Klebsiella pneumoniae* (4), *Escherichia coli* (4), *Clostridium difficile* (2) and viridans streptococci (2).

ET assessment of proxy indicator performance and PT surveillance

The ET reviewed medical records of 340 of the 851 patients surveyed by the PTs (40.0%). Among these patients, antimicrobial therapy was the most sensitive proxy indicator, detecting 95.5% of patients determined by the ET to have HAIs (Table 3).

The ET detected 24 HAIs, and ≥1 HAI in 22 patients, for a prevalence of 6.5% (95% CI 4.2–9.5%). Similar to the PTs, SSI was the most common HAI (9/24 HAIs, 37.5%) followed by pneumonia (5, 20.8%), BSI (3, 12.5%) and UTI (2, 8.3%). Pathogens were reported for 18 of the HAIs detected by the ET (75.0%); as for the PT, SA was identified as the most common pathogen (6/24 HAIs, 25.0%).

Overall agreement between the PTs and ET on the presence or absence of HAIs was moderate at the HAI level (kappa 0.47, 95% CI 0.30–0.64) and at the patient level (kappa 0.51, 95% CI 0.33–0.69). HAI discrepancies at the patient level were common. Forty-one HAIs in 35 patients were detected among the 340 patients surveyed by the PTs and the ET: 17 were detected only by the PTs, 10 only by the ET, and 14 by both teams. Thirty-two discrepancies were detected in these 41 HAIs; 27 of these (84.4%) were major discrepancies, where teams disagreed on whether an HAI was present or not (Table 4). HAI types that were most common among the major discrepant cases were PNEU (9/27 cases, 33.3%) and UTI (6/27 cases, 22.2%). Although the PTs and the ET detected similar proportions of HAIs that were PNEU and UTI, on the individual patient level there was no agreement between the teams on which patients had PNEU or which patients had UTI.

The RT determined that most major discrepancies (21/27, 77.8%) were due to problems understanding and/or interpreting NHSN HAI definition criteria. The RT was able to assign a correct determination to 26 of 27 major discrepancies (96.3%): 14 (53.8%) were not HAIs and 12 (46.2%) were HAIs. Resolution was not achieved for one PNEU case. A modified HAI prevalence was calculated using RT determinations for the discrepant cases. Among the 339 patients for whom there was PT and ET agreement on the presence or absence of HAIs, or for whom resolution was achieved, there were 13 patients with HAIs detected by PTs and the ET, plus an additional 9 patients with HAIs confirmed through the RT process, yielding a prevalence of 6.5% (95% CI: 4.2–9.5%), similar to initial estimates obtained by the PTs and the ET.

Discussion

In this pilot phase of CDC's HAI prevalence survey development effort, 6.0% of acute care inpatients had ≥1 HAI detected by the PTs—similar to the prevalence of 5.23% reported in the SENIC,[7] conducted more than 30 years ago, prior to widespread appreciation of HAIs as important causes of preventable harm in hospitalized patients. While implementation of effective HAI prevention measures in recent years[35] might suggest that HAI prevalence should have been lower in 2009, there are a number of potential reasons why HAI prevalence in this single-city pilot survey is similar to that observed in the 1970s. The SENIC included general adult medical and surgical patients and excluded children, obstetrical patients (except those undergoing cesarean section), and surgical subspecialty patients. It was also designed only to capture HAIs of the 4 major types (UTI, SSI, BSI and pneumonia), because at the time these were estimated to account for at least 80% of all HAIs.[7] Given that not all HAI types were included, it is possible that 5.23% is an underestimate of HAI prevalence in the SENIC. In addition, other factors may explain why the prevalence does not appear substantially lower in the current survey, conducted in an era of increased HAI prevention success: for example, greater severity of illness of acute care inpatients, differences in comorbidities of the patient populations under surveillance, and improvements in HAI surveillance definitions and detection methods.

While HAI prevalence in the current survey is similar to that reported in SENIC, the distribution and rank order of HAIs in this survey is different. SSIs in this survey were the most common HAIs detected by the PTs, accounting for almost one-third of all infections. This is similar to the 28% prevalence of surgical wound infections in the SENIC, [7] but in contrast to the results of an analysis by Klevens and colleagues using NNIS data from 1990–2002, which showed that just 20% of HAIs were SSIs.[8] In both of these previous efforts, UTIs were the most common HAI type, accounting for 53% and 36% of all HAIs, respectively,[7, 8] while in the current survey, UTIs accounted for just 15.5% of all HAIs. The exclusion of asymptomatic bacteriuria and funguria from the CDC's healthcare-associated UTI definition in 2009 likely explains in part the relatively lower proportion of HAIs that are now found to be UTIs. In addition, increased focus on appropriate use of urinary catheters, a major risk factor for healthcare-associated UTI, may also have contributed to the lower rank order of UTI in the current survey.

The proportion of HAIs other than the four major types in the current survey was approximately 24%, which is similar to that reported in the Klevens analysis.[8] It is perhaps surprising that gastrointestinal tract infections did not account for a larger proportion of HAIs in the current survey, given the increasing incidence of *Clostridium difficile* infection (CDI) in healthcare settings.[37, 38] *C. difficile* was reported as the cause of only 2 GI infections in this survey (3.4% of all HAIs), raising the possibility that existing NHSN GI definitions, which have not been updated in several years, are not adequately capturing the majority of healthcare-associated CDI cases. To address this concern, a specific definition of healthcare-associated CDI will be utilized in subsequent phases of CDC's prevalence survey.

Many of the existing NHSN HAI definitions were developed in the 1990s for use in internal quality improvement efforts and reporting to the NNIS system. In some cases, definitions are complex and multifaceted, and many are subjective and open to significant interpretation by the user. It is not entirely surprising, then, that understanding and/or interpretation of the NHSN definitions were the sources of most major discrepancies in HAI determinations. Significant interobserver variability has been reported for some of the NHSN HAI definitions[39, 40]; in this survey, the agreement between the PTs and the ET on HAI determinations was moderate, with a kappa of approximately 0.5. Not surprisingly, pneumonia and UTI cases accounted for many of the major HAI discrepancies. These are anecdotally regarded as among the most complex of the HAI surveillance definitions. To address this, more training in NHSN terms and definitions has been incorporated into subsequent phases of CDC's HAI prevalence survey development effort. CDC staff are also reviewing some of the current NHSN HAI definitions, including BSI, PNEU and SSI, as well as aspects of NHSN surveillance methodology, with the goal of making HAI surveillance more objective, streamlined, and in some cases automatable through use of electronic data capture.

We explored the performance of three proxy indicators in detecting patients with HAIs and found that one indicator in particular, antimicrobial therapy, detected almost all patients who were determined to have HAIs by the ET. The high sensitivity of antimicrobial therapy is likely related to the high prevalence of antimicrobial use in this survey population; approximately 46% of patients received antimicrobial therapy on the survey date or the calendar day prior to the survey date. We did not have the resources in this pilot to collect detailed information on antimicrobial use, but have incorporated this into the next phases of the survey. Based on its high sensitivity in identifying patients with HAIs in this pilot, we are using antimicrobial therapy as a proxy indicator to reduce the burden of medical record review in subsequent phases of survey development.

This pilot survey has several limitations, including its small size and restriction to acute care hospitals in a single metropolitan area. The results therefore may not be generalizable to other regions or to the United States. Furthermore, training of PT members in NHSN terms and definitions was limited, and was not provided for ET members. This may have contributed to the interobserver variability that we observed. Due to the single-day nature of the individual hospital surveys, PT and ET members were faced with a considerable amount of data collection to complete in a short amount of time. ET members had limited time to familiarize themselves with each hospital's medical information system, and at times encountered challenges in locating the necessary clinical information in patient medical records. We expect these factors also contributed to interobserver variability. We have attempted to address these limitations in subsequent phases of the survey development effort by 1) increasing the sample size of hospitals and patients; 2) increasing the geographic diversity of participating hospitals; 3) changing the data collection procedures so that HAI determinations are made through retrospective medical record review; and 4) providing enhanced training in NHSN terms and definitions and survey procedures to all data collectors involved in the survey.

The experience gained in this pilot survey has contributed to refinements in methodology and training that will improve the quality of CDC's multistate prevalence survey effort. Additionally, this pilot survey effort has contributed to a greater understanding of the potential sources of interobserver variability in NHSN surveillance methods. Expansion of prevalence assessments to a larger sample of U.S. hospitals and modification of operations in response to the lessons learned in this pilot should provide policy makers, public health workers, infection preventionists and healthcare providers with HAI and antimicrobial use data to inform the development and implementation of targeted surveillance and high-impact prevention programs.

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Table 1

Patient Demographic and Clinical Characteristics

Characteristic	No. (%) of patients (n = 851)
Sex	
Male	362 (42.5)
Female	481 (56.5)
Missing	13 (1.5)
Age category	
<1 year	98 (11.5)
1–17 years	27 (3.2)
18–24 years	35 (4.1)
25–44 years	145 (17.0)
45–64 years	271 (31.8)
≥ 65 years	274 (32.2)
Missing	1 (0.1)
Hospital location[a] on the survey date	
Critical care unit	125 (14.7)
Stepdown unit	80 (9.4)
Critical care or stepdown unit[b]	3 (0.4)
Specialty care area	35 (4.1)
Newborn nursery and special care nursery	47 (5.5)
Ward	553 (65.0)
Missing	8 (0.9)
Device use on survey date	
Any central line	237 (27.8)
Peripherally-inserted central catheter	140 (16.5)
Femoral line	14 (1.6)
Other central line[c]	85 (10.0)
Unspecified central line type	12 (1.4)
> 1 central line type	13 (1.5)
Urinary catheter	231 (27.1)
Ventilator	44 (5.2)
NHSN-defined operative procedure[d] during current hospital admission	252 (29.6)
Previous admission to the survey hospital in 3 months prior to survey date	218 (25.6)
HAI proxy indicators	
White blood cell count abnormality[e]	213 (25.0)
Temperature abnormality[f]	80 (9.4)
Antimicrobial therapy	389 (45.7)
≥1 indicators	489 (57.5)

[a] As defined by NHSN. Critical care units include level II/III and level III neonatal intensive care units.

[b] Patients for whom a single location was not assigned.

[c] Not including femoral lines or peripherally-inserted central catheters.

[d] Includes NHSN-defined “Other” (“OTH”) procedures.

[e] White blood cell count <4,000 cells/mm3 or ≥12,000 cells/mm3 (≥15,000 cells/mm3 for infants ≤1 year) on the survey date or the calendar day prior to the survey date.

[f] Temperature >38°C (all ages) or <36°C (infants ≤1 year) on the survey date or the calendar day prior to the survey date.

Table 2

National Healthcare Safety Network (NHSN) Healthcare-Associated Infections Detected by the Primary Teams

NHSN HAI Type (code)	No. (%) of HAIs (n = 58)
Surgical site infections (SSI)	18 (31.0)
Pneumonia (PNEU)	9 (15.5)[a]
Urinary tract infections (UTI)	9 (15.5)[b]
Bloodstream infections (BSI)	8 (13.8)[c]
Gastrointestinal infections (GI)	4 (6.9)
Skin and soft tissue (SST)	4 (6.9)
Lower respiratory infections (LRI)	2 (3.4)
Eye, ear, nose, throat, or mouth (EENT)	2 (3.4)
Cardiovascular system (CVS)	1 (1.7)
Central nervous system (CNS)	1 (1.7)

[a] Two of 9 infections (22.2%) were ventilator-associated.

[b] Five of 9 infections (55.6%) were catheter-associated.

[c] Eight of 8 infections (100%) were central line-associated.

Table 3

Performance of proxy indicators in identifying patients with HAIs as determined by the ET (N=340). PPV = positive predictive value. NPV = negative predictive value. HAI = healthcare-associated infection.

Indicator	HAI Present	No HAI	Total	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)
White blood cell count abnormality[a]							
Yes	11	75	86	52.4 (29.8–74.3)	72.8 (67.2–78.0)	12.8 (6.6–21.7)	95.3 (91.5–97.7)
No	10	201	211				
Missing	1	42	43				
Temperature abnormality[b]							
Yes	3	19	23	13.6 (2.9–34.9)	93.7 (90.4–96.1)	13.0 (2.8–33.6)	94.0 (90.7–96.3)
No	19	296	315				
Missing	0	2	2				
Antimicrobial therapy[c]							
Yes	21	118	139	95.5 (77.2–99.9)	62.8 (57.2–68.1)	15.1 (9.6–22.2)	99.5 (97.3–100)
No	1	199	200				
Missing	0	1	1				

[a] White blood cell count <4,000 cells/mm3 or ≥12,000 cells/mm3 (≥15,000 cells/mm3 for infants ≤1 year) on the survey date or the calendar day prior to the survey date.

[b] Temperature >38°C (all ages) or <36°C (infants ≤1 year) on the survey date or the calendar day prior to the survey date.

[c] On the survey date or the calendar day prior to the survey date.

Table 4

Healthcare-associated infection determination major discrepancies and resolution (N=27).

HAI No.	PT Determination	ET Determination	Discrepancy Source(s)[a]	Final RT Determination
1	BSI	No HAI	Data access; data collection error	BSI
2	EENT	No HAI	Data collection error	No HAI
3	GI	No HAI	Data collection error	GI
4	PNEU	No HAI	Data access	No HAI
5	PNEU	No HAI	HAI definition understanding/interpretation	Unresolved
6	PNEU	No HAI	HAI definition understanding/interpretation	No HAI
7	PNEU	No HAI	HAI definition understanding/interpretation	No HAI
8	SSI	No HAI	Data collection error	SST
9	SSI	No HAI	HAI definition understanding/interpretation	No HAI
10	SSI	No HAI	HAI definition understanding/interpretation	No HAI
11	SST	No HAI	HAI definition understanding/interpretation	No HAI
12	SST	No HAI	HAI definition understanding/interpretation	No HAI
13	SST	No HAI	HAI definition understanding/interpretation	No HAI
14	UTI	No HAI	Data access	UTI
15	UTI	No HAI	HAI definition understanding/interpretation	No HAI
16	UTI	No HAI	HAI definition understanding/interpretation	No HAI
17	UTI	No HAI	HAI definition understanding/interpretation	UTI
18	No HAI	CVS	HAI definition understanding/interpretation	CVS
19	No HAI	PNEU	HAI definition understanding/interpretation	PNEU
20	No HAI	PNEU	HAI definition understanding/interpretation	PNEU
21	No HAI	PNEU	HAI definition understanding/interpretation	PNEU
22	No HAI	PNEU	HAI definition understanding/interpretation	No HAI
23	No HAI	PNEU	HAI definition understanding/interpretation	PNEU
24	No HAI	REPR	HAI definition understanding/interpretation	REPR
25	No HAI	SSI	HAI definition understanding/interpretation; data collection error	No HAI
26	No HAI	UTI	HAI definition understanding/interpretation	No HAI
27	No HAI	UTI	HAI definition understanding/interpretation	UTI

PT = Primary Team, ET = Evaluation Team, RT = Resolution Team, HAI = healthcare-associated infection, BSI = bloodstream infection, EENT = ears/eyes/nose/mouth/throat infection, GI = gastrointestinal infection, PNEU = pneumonia, SSI = surgical site infection, SST = skin and soft tissue infection, UTI = urinary tract infection, CVS = cardiovascular system infection, REPR = reproductive tract infection.

[a]Possible sources included the following: 1) data access, in which the ET did not have access to test results available to the PTs (for example, results of cultures collected on the survey date); 2) data collection error, in which information necessary to make an HAI determination was clearly present in the medical record but was not recognized or recorded by the data collector; 3) HAI definition understanding/interpretation, in which data collectors lacked awareness or understanding of the criteria necessary to make NHSN HAI determinations. More than one source could be identified for any given HAI discrepancy.